RCN: OceanObsNetwork

Annual Report for 2015

Francoise Pearlman, Jay Pearlman and Albert Williams III, editors

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1. Overview.

The goal of the RCN OceanObsNetwork [RCN] is to foster a broad, multi-disciplinary dialogue, enabling more effective use of ocean observing systems, consistent with national and international efforts, to inform societal decisions.

To achieve this goal, the RCN has defined a series of objectives:

- Motivate commitments to sustaining ocean and marine observing systems
- Stimulate inter-disciplinary cooperation for both observations and analyses
- Facilitate open exchange of ocean data
- Promote interoperability
- Improve the flow of critical ocean observation information to key stakeholders
- Stimulate capacity building and retention in ocean and marine observations community

The RCN will also consider related issues such as integration of space-based and in-situ measurements, and innovative concepts in sensors, information systems and user interfaces. The network members may propose additional subjects.

See Appendix I for the complete RCN Terms of Reference.

The RCN consists of senior ocean scientist from the US and other countries from a number of ocean science disciplines. The RCN members and volunteers are listed in Appendix II.

Detailed information on meetings and reports are provided in the Appendix III.

The following paragraphs highlight the RCN activities for 2014/15.

2. Working Environment.

The RCN operates primarily through electronic information exchange. Its members use websites, discussion fora and other tools for communication and collaboration.

The RCN meets three times per year, two virtual meetings and an annual in-person meeting. In 2015, the virtual meetings were held on June 30 and October 16. The face-to-face meeting will be held in San Francisco on December 13, prior to the start of the AGU meeting.

The RCN Plenary reviews and comments on Working Group (WG) reports prior to their public release and forwarding to appropriate parties. Coordination of the RCN activities with existing networks is facilitated by RCN members whose organizations are participating in those networks.

3. Working Groups.

The RCN is primarily a forum to address issues of enhancing ocean observation and information and the challenges of multi-disciplinary research across the ocean sciences. It is not a body

chartered to undertake new scientific research. Issues engaged by the RCN are addressed by the body as a whole (Plenary) or through working groups constituted by the RCN. A working group generally focuses on one of the RCN objectives and produces a report clearly identifying the issues, approaches, impacts and recommendations for achieving the objective(s).

Working groups have a defined term of operation, generally nine months (renewable), to assess issues and then submit their recommendations for review by the Plenary. The reviewed recommendations will be provided to international, national and program level organizations for consideration and possible implementations.

Members of the RCN and other invited experts constitute working groups. They operate under a Working Group Terms of Reference that include objectives, a schedule, an operations modality and a list of deliverables. Network members may serve on multiple working groups. In their deliberations, the working groups may invite external experts to make presentations and provide background on issues being addressed.

Five working groups were active or in initiation phase in 2015.

A. The Open Data Working Group (Completed)

A working group report was issued on May 30 2013. A decision was made by the working group to publish a peer-reviewed paper on open data and recommendations for expansion of data access. The paper was published in Earth Science Informatics (Earth Sci Inform

DOI 10.1007/s12145-014-0202-2) in 2015

B. The Outreach and Education Working Group

The working group was started mid-August of 2012 and continues the webinars series, “the Blue Marvel - Ocean Mysteries”. The webinars are available for viewing and access through the IEEE OES website. The webinar presentations – dates and speakers - are summarized in the events list of Section 7 of this report.

C. The RSS-In-situ Working Group (Completed)

This working group addressed how to integrate future satellite measurements with future measurements from in-situ ocean-observing systems to study ocean/coastal processes. The timeframe for technology being examined was 2020 and after. The subject addressed both observations and the coupling of data with models for improving the understanding of the complex coastal environment with its combination of ocean, rivers and weather interactions. A report was issued on June 1 2015.

D. Support for BIO- TT

The RCN worked with the Interagency Ocean Observation Committee’s (IOOC) Biological Integration and Observation (BIO) Task Team in organizing a workshop with the goal to identify and prioritize additional crosscutting biological and ecosystem observational needs (beyond the existing 6 IOOS biological core variables). Bringing together a broad range of ocean biologists, the workshop provided a forum for identifying and prioritizing needs along with understanding the maturity of observation techniques for measuring key biological essential ocean variables. The workshop was held in November 2014 and the final report and recommendations were formalized in 2015 and submitted to the US government for release clearance.

E. Sensor Working Group

A working group has been formed to look at sensors that can support the emerging biology essential ocean variables. The group held initial meetings in 2015 with the objective of identifying existing capabilities, trends in sensor development and gaps in observation capabilities. The report is expected to be available for review in 2016.

F. Citizen Science Working Group

A working group was initiated in November 2014 to look at existing citizen science activities and areas for which further emphasis can be placed. Presentations were given at the December 2014 RCN meeting. Further work is to be defined by the working group leads.

4. Outreach and Dissemination.

In addition to the webinars mentioned above, RCN members participated in national and international meetings such as the IEEE/MTS Oceans 2015 in Genoa, Italy and in Washington DC, the AGU and EGU, and the GEO plenary in Mexico City. They also interfaced with project activities focused on interoperability such as the NeXOS, Atlantos and Ocean Data Interoperability Platform (ODIP II) programs. Presentations were given, and papers released as part of the proceedings. Papers and selected presentations are available on the RCN website.

5. Web Outreach.

The following websites provide information regarding RCN activities:

- Oceanmysteries.net (webinar advertising and registration).
- Oceanobsnetwork.org (IODE)
- Oceanrcn.org
- https://sites.google.com/site/oceanobservingrcn/ (CSIRO)

6. Events and activities.

Date 11/14-10/15	Activity	Reference
Nov-Dec 2014	BIO TT report development	
Dec 14	RCN Meeting	Face-Face annual meeting
February 27	ASLO meeting - session on ocean sensors	Address the next generation of insitu sensors for ocean observation
March 10	Ocean Data Interoperability/RDA Meeting	Data standards and interoperability – data harmonization
April 15-16	EGU/COOPEUS meeting	Ocean Information Infrastructures - coordination
April 20	ODIP Meeting	Interoperability
May 19	Oceans Meeting 2015	Observation systems
May 27	Blue Planet Symposium	RCN presentation and ocean observations discussion
June 1	RSS-Insitu WG report	Report released
June 30	RCN virtual meeting	
September 15	Sensor WG discussion	Formulating report
October 16	RCN virtual meeting	
October 19-22	Oceans Meeting 2015	Addressing Advanced Study Institute
October 22	Webinar Series	Presentation by Joaquin Del Rio
October 16	RCN Meeting	Fall meeting via webex
December 2	Webinar Series	Presentation by Laurent Delauney (Bio-fouling technology)
December 13	RCN Meeting	Meeting – in person – at San Francisco

Appendix I – RCN Terms of Reference.

Background

The oceans provide many important functions within the Earth system including strong coupling with weather and climate dynamics, providing food and energy resources, supporting trade and commerce, offering extensive stabilization for variations in our environment and being a resource for biodiversity. The need for improved coordination in ocean observations is more urgent now given the issues of climate change, sustainable food sources and increased need for energy. Ocean researchers must work across disciplines to provide policy makers with clear and understandable assessments of the state of the ocean.

New technologies and approaches are emerging to vastly improve ocean observations. Cabled observatories are an example of a paradigm shift, providing a relative abundance of power and bandwidth for observations covering scales from cm to km and times from seconds to decades. Sensors traditionally only available in laboratories can now be adapted for in-situ observations. The potential for interdisciplinary collaboration is significant. The Oceans RCN is a forum to address these issues and develop recommendations on key topics of ocean observation and information.

Goal

The goal of the RCN is to foster a broad, multi-disciplinary dialogue, enabling more effective use of ocean observing systems, consistent with national and international efforts, to inform societal decisions.

Objectives

To achieve this goal, the RCN has defined a series of objectives:

- Motivate commitments to sustaining ocean and marine observing systems
- Stimulate inter-disciplinary cooperation for both observations and analyses
- Facilitate open exchange of ocean data
- Promote interoperability
- Improve the flow of critical ocean observation information to key stakeholders
- Stimulate capacity building and retention in ocean and marine observations community

The RCN will also consider related issues such as integration of space-based and in-situ measurements, and innovative concepts in sensors, information systems and user interfaces. Additional subjects may be proposed by the network members.

In achieving these objectives, the RCN will motivate new research outcomes, provide wider visibility for the value and impacts of ocean observations and encourage a new generation of scientists to focus on the oceans and their challenges.

Operations and Working Methods

The RCN is primarily a forum to address issues of enhancing ocean observation and information. It is not a body chartered to undertake new scientific research. Issues engaged by the RCN will be addressed by the body as a whole (Plenary) or through working groups (WG) constituted by the

RCN. A working group will generally focus on one of the objectives cited above and will produce a report clearly identifying the issues, approaches, impacts and recommendations for achieving the objective(s).
Working groups will have a defined term of operation, generally six months (renewable), to assess issues and then submit their recommendations for review by the Plenary. The reviewed recommendations will be provided to international, national and program level organizations for consideration and possible implementations. Working Groups will be constituted by members of the network and other invited experts. They will create Terms of Reference including objectives, a schedule, an operations modality and a list of deliverables. Network members may serve on multiple working groups. In their deliberations, the working groups may invite external experts to make presentations and provide background on issues being addressed.
The RCN working environment will be as follows:

1. The RCN will operate primarily through electronic information exchange. The RCN will have websites, discussion forum and other tools for communication and collaboration.
2. The RCN will meet three times per year, two virtual meetings and an annual in-person meeting.

3. The RCN Plenary will review and comment on the WG reports prior to their forwarding to appropriate parties.
4. The RCN will work closely with existing coordination bodies and mechanisms for ocean and marine observations. Coordination with existing networks will be facilitated by members of the Steering Committee and senior network members whose organizations are participating in existing networks such as those under UNESCO IOC and GEO.

Outputs

The RCN will develop and deliver reports covering subjects that support achieving the objectives above. The reports will identify issues, approaches and recommendations for achieving the objectives.

Participation

The RCN will be a long-term international forum on observatories, data, modeling and information for scientists and users of ocean information. Broad participation of physical, biological, and biogeochemical oceanographers in the RCN is essential. Inclusion of nonscientist end users and decision makers in the RCN is strongly encouraged. A list of current participants is maintained by the project office. Additional network membership may include scientists from current observing systems and also data and information users from government, industry and education and research institutions. These will initially be solicited though contacts by the Steering Committee and the senior network members.

Appendix II – OceanObsNetwork Members and Participants.

First Name	Last Name	Organization	E-mail address
Simon	Allen	CSIRO	simon.allen@csiro.au
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Dawn	Wright	ESRI	dwright@esri.com
Jim	Yoder	WHOI	jyoder@whoi.edu

Appendix III - Minutes of RCN Meetings

A. **Minutes of RCN Virtual Meeting June 30, 2015**

Attending the meeting were: Mike Bourassa, Eric Delory, Paul DiGiacomo, Helen Glaves, Ed Gough, Eileen Hofmann, Bob Housman, Jay Pearlman, Hans-Peter Plag, Heidi Sosik, Maciej Telszewski, Sandy Williams, Dawn Wright, Jim Yoder

The agenda included:
Sea Change report (ocean decadal survey) - Jim Yoder
Biology EOVs, results of EOV discussions - Samantha Simmons (reported by Jay Pearlman)
Blue Planet meeting - Hans-Peter Plag
Reports and Plans.

Sea Change
Jim Yoder reported on the Sea Change effort in NSF. Under Clinton's $500B/yr surplus, planning was done to double the funding for NSF in five years. Under Bush, with 911 and Afghanistan, this surplus became a $500B/yr deficit so NSF fund doubling, which started with a 14% increase in 2003, stopped and the budget has been flat. However, Infrastructure spending continued with OOI Planning, new ships (Regional Class), Nereus, Alvin etc. A couple of years ago, David Conover recognized that there was a growing need for operations costs and these compete with research budgets. Should there be a rebalancing?
NSF supported an NAS review which identified high priority science themes based on community inputs. Ideas were sorted and balanced according to: readiness, societal impact and importance to research.
The evaluation considered IODP, OOI, Fleet & Deep Submergence (not construction but research). The recommendation was to rebalance through a reduction in ops/maintenance funding and restoration of funding for basic science. As a target, infrastructure should be no more than 40-50% of the total budget. The goal is to reduce 10% of the infrastructure costs in the next budget and another 10% in the out years. The Seismic Ship is to be taken out of service. Money is being moved from Infrastructure to research with the following targets: most reduction would be to OOI, next IODP and smallest to the fleet; look at current ship design to see if balanced and also look for partners to offset costs (similar to IODP) and for the Fleet, reduce the number of vessels from 3 – 2. The seismic ship will be removed from service to reduce costs. Rick Murray's report is in process of being implemented at NSF in FY15&16.

There was a discussion on how to move toward more international partnering. For example, OOI will be out of the construction phase in Fall 2015 and there may be a call for operations proposals that could include international participation. However, nothing has been decided yet. Jay commented that the Galway Statement calls for International Partnerships, for example, GOOS, IOOS, AtlantOS. Ed Gough noted an apparent fragmentation in international collaboration. He asked whether the Galway agreement would be the framework for cooperation. Helen said the Bilateral Arctic program is providing coordination for the northern latitudes. Helen noted the upcoming meeting in Dalhousie for international scientific planning

and sharing of information on the research agenda. She asked if anyone else has received an invitation. No one had. Please let Helen know who is going.
Eric spoke about AtlantOS, which is a new project focused on collaboration for Atlantic ocean observations. When the partnering is complete, there will be opportunities for Europe, Canada, US and southern hemisphere countries. Dawn asked what COL is doing? Might they be the leader? Ocean Leadership is advocating expanded support for NSF geosciences and climate research. Under the current plans, there is a cut 9% and the continuing resolution, which freezes the budget.

Biology EOV
Jay gave Samantha Simmons' Biology EOV report. It includes a survey from agencies in the US doing research and a Panel in November 2014 which addressed the expanded need for EOVs. The report has recommendations to add EOVs to the IOOS structure. The report is under review for release and, when it is available (this month), the RCN participants are encouraged review it and see how it can be adapted for application.

Blue Planet Symposium
Hans-Peter Plag talked about second Blue Planet Meeting May 27-20, 2015, which was held (190 attending) in Canberra. There were two days of plenary sessions. The last day was breakout sessions on each component (sustained ocean observation, ecosystems and food security, forecasting, coastal zone and outreach. There were lots of ideas (such as a mangrove service) and coastal zone observing systems. The schedule was quite full and there was a need for more time for discussions. Documenting what was done with a Telecon July 3 but there is an issue of sustained documentation. After a year the URL to Website disappears. Paul mentioned that SAR will be hosting a repository for Blue Planet materials. There was a suggestions that an article on the meeting be offered to EOS.
Blue Planet is part of GEO. BP continues to be a broader initiative where nations come together and could be an incubator for flagships in areas such as water quality or sea level. There are Initiatives and Flagships but it isn't clear which Blue Planet is yet.

The third Blue Planet Symposium will be in Monterey 2016 on the Thursday September 22, 2016 during OCEANS'16 Monterey and continue to Saturday morning followed by an excursion.

Reports
Jim Yoder reported that there is now a DOI link on the In Situ vs. Remote Sensing for Coastal Studies working group report. It is now available through the Woods Hole Library and is citable.
Jay, Mark and Maciej reported that the Dec 2014 RCN meeting discussion on EOV evolution has progressed and a discussion paper has been started. Bourassa said GOOS has had Panels to see how observation platforms can combine EOV measurements. There is consideration of having a workshop in 2016/7 coordinated by Samantha Simmons, Mark, Maciej, and Jay. Mark said that infrastructure is an issue that needs to be addressed.
Helen reported that the Ocean Data Interoperability Project is ramping up and will continue for three years. Metadata standards, sensor web enablement, and cruise reports will be included. European and Australian partners are funded but they are awaiting funding from NSF; Marie

Uhle at NSF said it is coming. Helen also mentioned that there will be a session at AGU dealing with international collaboration in data and invited participation.

The next RCN meeting will be in early fall (webex). The annual face-to-face meeting will be in San Francisco Sunday, December 13, the day before the AGU meeting.

Meeting adjourned

B. OceanObs Research Coordination Network Meeting Minutes

October 16 2015

The meeting was held from 10AM to 11AM EDT via Webex. The meeting included three presentations and short descriptions of RCN and Community activities. A partial list of attendees includes:

Simon Allen, Mark Bourassa, Paul Bunje, Francisco Chavez, Eric Delory, Janet Fredericks, Eileen Hofmann, Paul Holthus, Bob Housman, Matt Mowlem, John Orcutt, Jay Pearlman, Francoise Pearlman, Hans-Peter Plag, Sam Simmons, Heidi Sosik, Sandy Williams

Agenda

Lab on a Chip by Matt Mowlem

Ocean Sustainability by Paul Holthus

In situ Sensor advances by Eric Delory

Community Activities:

Bio Sensors - Francisco Chavez

Bio Task Team status - Sam Simmons/Bob Houtman

Blue Planet Initiative – Hans Peter Plag

Meeting in San Francisco December 13

Lab on a Chip by Matt Mowlem

Dr. Matt Mowlem is the head of the Sensors Development Group at the National Oceanography Centre, Southampton, UK. His research focuses on the development of novel biogeochemical sensors, with an emphasis on in situ systems. He contributes to many European observation projects and many innovations in sensor technology.

Dr. Mowlem presented the work of the National Oceanography Centre creating “lab on a chip” for insitu marine observations. The presentation emphasized the developments for biogeochemical sensing, but the applications and capabilities are broader. For example, in the areas of sensor, activities include: Water physics (CTD), Water chemistry, Water biology, Sediment flow and properties, Wave height/ breaking and Sea surface fluxes.

In addition, there is work on samples and the infrastructure that surrounds the sensors from platforms to communications.

- Samplers
- Continuous water

- Gas tight water
- Particles
- Genomics
- Landers and benthic systems
- Communication systems

Even with the expansion of capabilities, monitoring biogeochemistry on a global level is a significant challenge. ARGO floats present opportunities, but cannot address the full range of chemistry and analytical targets in the ocean. Other platforms could be available also. The key message there are lots of potential platforms and opportunities to measure biogeochemistry but this is not routinely done because of the lack of robust cheap sensor systems with sufficient performance.

For biogeochemistry, Matt noted areas for targeting:

Salinity (microsensors, 0.002psu)

Nutrients (microM coastal / deep, nanoM open ocean)

Trace metals (n -fM)

Gases (n-uM)

Carbonate system (0.001 pH equiv)

Small organics, e.g. PAH, PCBs (f-pM)

Proteins and large organics (copies / L)

Nucleic Acids: organisms, eDNA (copies / L)

Whole cells (cytometry)

Radionuclides.

The sensors needed are quite diverse to achieve these objectives. The also have a wide range of maturities so that a comprehensive set of observations is emerging, but further development is anticipated. Lab on a chip is an interesting way to mature a selected set of measurements and a way to broaden applications. The lab on a chip currently under development at NOC includes the following measurements: Nitrate, Nitrite, pH, Phosphate, Silicate, Iron, Manganese, Total Alkalinity, Ammonia, DOP, Dissolved Inorganic Carbon, ….. . The advantages of lab-on-a-chip are: Small footprint, Low power, Easy to build, Low reagent consumption, No waste emission. As the technology matures, there are, of course, other advantages in cost, consistency of observations and broad deployment.

Matt gave a number of interesting examples of measurements in deep waters and in estuaries. These included pH, nitrates, nitrites, and macronutrient cycles. Data and sensor images are available in his presentation. The presentation will available on the RCN website.

There was a question on biofouling of the lab-on-a-chip. Matt related experience of measurements in estuaries and in surface waters for a year without biofouling issues. There are a number of reasons for this:

The microfluidics operate in a dark environment; there is a 0.4-micrometer filter at the entry to the fluidics section; and the reagents used are aggressive. NOC had expected fouling and was surprised that there was no fouling. There are, of course, cases where fouling could occur such as something getting stuck on the filter and changing its characteristics. There are other projects that are addressing biofouling whose results are being monitored.

Matt pointed out the sensitivity of sensor system - typically sub two micromole for nitrates,

Heidi asked about calibration of the sensor. Matt said calibration can be done between each measurement, but it is not felt that this is repetition level is necessary. Typically a calibration is done every 10 measurement.

Paul Holthus on Ocean Sustainability

Paul Holthus of the World Ocean Council gave the next presentation. Paul is founding President and Chief Executive Officer of the World Ocean Council. He works with the private sector and market forces to develop practical solutions for achieving sustainable development and addressing environmental concerns, especially for marine areas and resources. His experience ranges from working with the global industry associations or directors of UN agencies to working with fishers in small island villages. He has been involved in coastal and marine resource sustainable development and conservation work in over 30 countries in Europe, Asia, the Pacific, Central America and Africa.

Paul discussed the question of ocean sustainability. This is global issue involving all segments of ocean participation. The discussion was provided in the context of an upcoming conference by WOC on Ocean Sustainability. The Sustainable Ocean Summit (SOS) is a global, multi-sectorial platform for leadership of companies and organizations to advance the development and implementation of industry-driven solutions to ocean sustainability challenges. The WOC is looking at a 15-50 year vision of the oceans with a look at different segments of the ocean industry including areas such as aquaculture, renewable energy, mining and fishing. The objective of the meeting is to address alignment across sectors, which can create long-term capabilities to more broadly address sustainability. This work of WOC should be of interest to the science community. Paul suggested that there are opportunities for joint collaboration and mutual benefit. For example, industry has platforms and vessels that can be used for ocean observations. Paul will report on the results of the conference at the RCN December 13 2015 meeting.

In situ Sensor advances by Eric Delory

Dr. Eric Delory has worked in ocean science and biomedical engineering in positions ranging from applied research to management, in Europe and Asia. Before specialising in ocean observing systems and infrastructures, he developed hardware solutions, signal processing and machine learning techniques, applied to bioengineering and ocean sciences. Oceanic Platform of the Canary Islands, a now long-term funded infrastructure for ocean science and technology, where he became head of the observatory (PLOCAN) in 2010. Among other activities, Eric is coordinator of the NeXOS project that is part of the European Commission Oceans of Tomorrow program.

Dr. Delory addressed two areas in his presentation – passive acoustics and transversal innovations. Transversal innovations are those areas that can support multiple sensors such as biofouling innovations or new data management capabilities. Working from sensor to user, application of recent technologies such as Pluggable Underwater Connector with Knowledge (PUCK) enable increased interoperability platform across sensor type. Adding to this web-enabled sensor operating system (SOS) sensor to user web enabled software addresses insertion of up to date technology into observation systems. For acoustic systems, the incorporation of embedded processing enables improved acoustic measurements in bandwidth limited systems and platforms. NeXOS is a European Oceans of Tomorrow 2013 project that is addressing these issues. Through the development of a Smart Electronic Interface for Sensor Interoperability (SEISI) incorporating PUCK, SOS and other capabilities consistent with open standards and a focus on miniaturization and low power consumption, there are new opportunities for multi-sensor functionality for mobile platforms.

Eric gave an example of AUVs and an acoustic sensor interfacing with the platform through an RS232 link. While the RS232 was identified, multiple options were mentioned including many of the existing solutions for both on-board processing and communications (e.g. Ethernet connectivity). Looking at the RESON 4032 hydrophones, Eric showed data at three frequencies (63 Hz, 125 Hz and an integrated band from 10Hz to 10KHz). In NeXOS, acoustic sensors with much higher dynamic range and sensitivity will be available for testing during the next year. Eric summarized these developments planned for NeXOS including the platform that are planned for test and validation. The project is about halfway into its four-year life and testing will be started in 2016.

Community Activities

Bio Task Team status - Sam Simmons/Bob Houtman updated the status of the Bio Task Team report. The report is the results of surveys to government agencies and a panel of science experts as to priorities for ocean biology measurements. The report has grouped observations into priority categories that complement the current IOOS EOVs. The report is undergoing review in the government with release expected this year. Upon release, Sam will provide a presentation to the RCN.

Bio Sensors - Francisco Chavez is leading a working group on sensors for ocean biology. This is a follow-on to the Bio Task Team. The question of matching requirements with measurement capability – present and planned – is a part of prioritizing the biology essential ocean variables. The working group is creating a matrix of possible sensors and their attributes. The outcomes will be provided to the ocean community to stimulate further discussion.

Blue Planet Initiative – Hans Peter Plag noted that the Blue Planet Initiative of the Group on Earth Observation concluded its second workshop earlier this year in Australia. Outcomes will be available in proceeding that will be published shortly. The third meeting will be held in 2017 in the US.

Meeting in San Francisco December 13 – Jay Pearlman noted that the next meeting of the RCN will be an in person meeting to be held in San Francisco the day before the AGU. An agenda is being confirmed and will be available in mid November.

There were no questions about the community reports.

Jay Pearlman thanked all the speakers and the RCN attendees for their participation. The meeting was adjourned.

C. Meeting Report for the Research Coordination Network (RCN) OceanObs Face to Face meeting, December 14, 2014

The OceanObs RCN is a five-year National Science Foundation (NSF) funded project. The RCN face-to-face meeting takes place once a year on the Sunday prior to the American Geophysical Union (AGU) conference in San Francisco, CA. This year's one-day meeting was held at the Marriott Marquis Hotel. The 24 attendees came from the US, Europe and Australia. A summary of the presentations and discussions is provided below.

Agenda

Annual Meeting of the OceanObs Research Coordination Network
San Francisco, CA, December 14 2014
Marriott Marquis Hotel, Club Room

Time	Subject	Participants	Panel Chair
8:45AM	Welcome	Jay Pearlman IEEE; Albert Williams 3rd, IEEE	
9:15AM	Essential Ocean Variables (EOV) Panel	Raphael Kudela, UC Santa Cruz Mark Bourassa, Florida State University, Maciej Telszewski, IOOCP	Bob Houtman, NSF
10:15AM	Break		
10:45AM	Interoperability Panel	Gilles Ollier, European Commission, Cyndy Chandler, Woods Hole Oceanographic Institute (WHOI) Dawn Wright, ESRI	Stefano Nativi, CNR
12:00PM	Lunch		
1:00PM	Observatories Panel	Laura Beranzoli, EMSO Oscar Schofield. Rutgers University Kate Moran, Ocean Networks Canada	Heidi Sosik, WHOI
2:15PM	Glider Discussion	Oscar Schofield. Rutgers University	
2:45PM	OOI Report	Oscar Schofield, Rutgers University	
3:15PM	Break		
3:45PM	Reports	Martin Visbeck, Helmholtz Center for Ocean research Hans-Peter Plag, Old Dominion University Deborah Glickson, National Academy of Science	
4:20PM	Citizen Observations Panel	Julia Parrish, University of Washington Mairi Best, EMSO	John Orcutt, UCSD
5:05PM	Summary	Jay Pearlman, Albert Williams 3rd	
5:20PM	Adjourn RCN		

Meeting Summary

Jay Pearlman introduced the RCN meeting. The RCN overview summarized the RCN Motivation: "*Foster a broad, multi-disciplinary dialogue, enabling more effective and sustained use of ocean observing systems for addressing local, national and global challenges"*. The RCN addresses issue of the ocean research community through discussion/working groups. The current status of the working group tasks was summarized: Completed - Open Data; Ongoing - Community Building, Insitu-Remote Sensing (RS) Interfaces, Biology core variables (with BIO-TT), Ocean biology sensors, and Citizen observations; Future - Standards and Best Practices; Sustainability. For example, the insitu- RS Interfaces working group developed a series of

recommendations, looking at a use case on river estuary dynamics. At this Face-to-Face meeting, objectives include: identifying key issues and making recommendations; reviewing Insitu-RS working group recommendations; and updating the status of the Oceanobs RCN activities. Working groups reports are peer reviewed.

Introductions.(by Pariticipants)

Bob Hautman - NSF, Jay Pearlman – IEEE, Simon Allen - CSIRO, Mairi Best- EMSO, Laura Beranzoli from Italy - EMSO, Gilles Ollier - EC, Kate Moran - ONC, Julia Parrish - Dean at UW and Citizen Science, Sandy Williams - WHOI, Francoise Pearlman - IEEE, Dawn Wright-Esri, Stefano Nativi - CNR, Mark Bourassa - FSU, Maciej Telszewski - IOCCP, Hans-Peter Plag-ODU, Raphe Kudela - UCSC, Tom O'Reilly - MBARI, Software, John Orcutt—UCSD, Citizen Observations, Ketil Koop-Jacobsen – Bremen University and COOPEUS, Cindy Chandler - WHOI, Iain Shepherd – EC Europa by Webex. Note: the following attendees arrived after the introduction: Oscar Schofield – Rutgers, Martin Visbeck - Helmholtz Center for Ocean research, and Deborah Glickson - National Academy of Science/National Research Council. During his introduction, John Orcutt indicated that the paper developed by the open data working group had been accepted for publication. He also mentioned that he is now the editor of a new AGU publication.

Essential Ocean Variables (EOV) panel - chaired by Bob Houtman; panel members Maciej Telszewski, Mark Bourassa, and Raphe Kudela.

Maciej Telszewski, Director of the International Ocean Carbon Coordination Project (IOCCP) addressed the question: Why a Framework? OceanObs'09 identified tremendous opportunities and challenges for a global observation system of systems. The Framework for Ocean Observing (FOO) was written after three years of work. It is a simple system based on Inputs (requirements), Processes (Observations), and Outputs (Data & Products). Societal drivers pre-FOO were climate and weather. But Fisheries, Regional priorities, Real-time Services, Assessments and Management of ecosystems are also important, and were included in the framework. A matrix illustrates how Ocean variables organized by disciplines (Physics, Biogeochemistry, and Biology) contribute to the Global Ocean Observing System (GOOS) application areas such as Climate, Real-times Services, and Ocean Health. A biogeochemistry (BGC) EOV workshop was held in Townsville, Australia, in November 2013. A Townhall meeting was held at AGU/OSM-2014 in Honolulu in February 2014. Over 100 colleagues attended the Townhall. The audience was invited to consult a draft EOV Report and 9 Specification Sheets, one for each proposed EOV, posted on IOCCP's website (http://www.ioccp.org/foo). A GOOS Webinar on the subject was the 3rd step in getting input from the community on BGC EOVs. They came up with major societally-driven questions, and a list of variables to measure for each question. The questions are summarized below:

•The role of ocean biogeochemistry in climate
–Q1.1 How is the ocean carbon content changing?
–Q1.2 How does the ocean influence cycles of non-CO_2 greenhouse gases?
•Human impacts on ocean biogeochemistry
–Q2.1. How large are the ocean's "dead zones" and how fast are they changing?
–Q2.2 What are the rates and impacts of ocean acidification?
•Ocean ecosystem health
–Q3.1 Is the biomass of the ocean changing?
–Q3.2 How does eutrophication and pollution impact ocean productivity and water quality?

The list of variables to measure each question was also provided (there were about 40). It is not possible to measure everything. EOVs are driven by requirements but also negotiated with feasibility in mind. A graph was generated with the best targets containing 9 ocean variables: 1)Oxygen; 2)Macro Nutrients; 3)Carbonate System; 4)Transient tracers;5)Suspended

Particulates; 6)Particulate Matter Transport;7)Nitrous Oxide; 8)^{13}Carbon; and 9)Dissolved Organic Matter

Bio-optics headed the list. Carbonate systems had the highest impact but less feasibility. Oxygen and micronutrients were on the longer list. For example dissolved oxygen requires net community production and many other things to be meaningful. Then specifications of present observing elements for oxygen were listed. Future observing elements such as ship of opportunity were considered. Data and information creation requires a plan as well concerning delivery, storage, searching etc. Links and references were populated. www.ioccp.org/foo is the URL.

Mark Bourassa presented Physical Essential Ocean Variables. IOOS's variables include salinity, temperature, bathymetry, sea level, surface waves, surface (vector) currents, ice concentration, surface heat flux, and bottom characteristics. GCOSS Physical Variables include: Surface: Sea-surface temperature, Sea-surface salinity, Sea level, Sea state, Sea ice, Surface current, and Ocean color. He does not have a good grasp on how the physical variables combine with the chemical and the biogeochemical variables., Carbon dioxide partial pressure, Ocean acidity, Phytoplankton.
Subsurface: Temperature, Salinity, Current, Nutrients, Carbon dioxide partial pressure, Ocean acidity, Oxygen, and Tracers. We have done a lot of work already that need not be repeated. Working together is easier than in the past (there is a lot of goodwill). Surface heat fluxes have been very recently available. Mapping from observations to EOVs and Observatory networks gives a complex connection diagram. Examples include weathering of oil depending on salinity as measured from pinniped mounted sensors. Temperature has a huge impact. Surface temperature processes by duration, horizontal scale, and also by depth. Surface vector currents are influenced by sea level anomalies, wind stress, waves and bathymetry (Stokes drift), inertial oscillations. Waves mix when they break and bubbles as well as organisms are affected. Ice concentration has six listed issues. Bottom characteristics also play a role. Some things can't be done from existing observations. There is a great rush to get those done.

Raphe Kudela, speaking on behalf of Samantha Simmons, presented the work of the Biological integration and observation task team (Bio-TT). In 2002 Core IOOS Variables including in the Biology area were identified**:** fish species and abundance, zooplankton species and abundance, optical properties, ocean color, and phytoplankton species. The goal of TT is A. to improve the availability of existing IOOS core biological variables, and B. Identify, and prioritize additional cross-cutting biological and ecosystem observation needs. Actions were to Design and execute a survey. A workshop was held Nov 4-6, 2014 with 35 participants. Primary producers included pelagic phytoplankton, zooplankton down through pathways. Prioritization was hard since most of the biology was in the low impact, low feasibility quadrant. Scored on the 5 themes of GOOS BEP was done. Outputs of the workshop were: List of variables, Recommendations, Workshop Report, and Formation of a bio-sensor Working Group. The priority results highlighted primary productivity and fish abundances.

Discussion: Tom O'Reilly asked if ocean color was deemphasized and the reason was that it only did surface productivity. Kate Moran asked about the time frame of the plan. Mark answered that most existing platforms measure many EOVs; selected measurements are fit for purpose rather than using sampling. The time frame depends on successful funding from scientific

research proposals, not observation programs. Maciej said that they have the observation systems out now but quality needs to be assured. Mark said that we are trying to stress the value in the observations. Bob Hautman said there are a lot of observation systems that are being funded but what additional observations should be made at the same time is unclear. Simon Allen asked about fish abundance.

Panel on Interoperability – chaired by Stefano Nativi; panel members Gilles Ollier, Cindy Chandler, and Dawn Wright.

The challenges are not just technical; that is just the tip of the iceberg. Policy, access

requirements, sustainability, governance are all organizational issues, and then there are economic, cultural and legal issues. Covering the full Interoperability space involves standardization , federation, and brokering/mediating. On going programs include Research data Alliance (RDA), GEOSS, NSF EarthCube, and Belmont Forum. Challenges include Open Access, multidisciplinarity, crowdsourcing, true scalability, consummerability and others including International brokering infrastructure governance. Infrastructures and Systems interoperability constitute first-class science.

Gilles Ollier is the first speaker, addressing multi-disciplinary interoperability for ocean research - EU Research on Ocean Observations. The European Commission supports large programs in earth observation via Copernicus. Existing observation systems have been developed independently. A large part of the ocean is not measured in-situ. Regional and global coordination is increasing; new data sources are emerging; new technologies will substitute for present technologies. Gilles Ollier gave several examples of existing FP7 and Horizon 2020 projects. Marine Ecosystem Dynamics and Indicators are needed for North Africa (Medina): most of the Mediterranean observations are from the north side of the sea. In the Medina project, the coastal area is most important but the African side needs compatibility with EU countries. The work continues with help from AfriGEO. The Baltic Sea BONUS program is similar joining 8 Baltic Sea States into a single joint research program. The BONUS components such as BAMBI, BLUEPRINT, and AFISMON focus on new methods of monitoring, surveillance and assessment. A new regional large project, the Integrated Atlantic Ocean Observing System, IAOOS, emphasizes in situ observations. The project includes both Northern and Southern Atlantic. The goal is to fill observational gaps, reduce the costs of in-situ ocean

observation, foster interoperable exchange of data. There are international partners from both sides of the Atlantic.
New data sources come from "citizen observatories". Mobile devices give everyone an observatory and for coastal areas, in-situ observations with more measurement points are available. Even the Chinese can individually monitor air quality with mobile devices. In the Citizen Observatory for coastal and ocean optical monitoring (Citclops), color of the ocean in-situ, transparency and fluorescence can be measured with do-it-yourself Smart Phones, with the results sent to a server. New sensor projects include SCHeMA, (Anthropogenic compound and bio-physicochemical parameters) with ion selective membranes, antifouling gel integrated micro sensor arrays (GIME) and (Bio-) polymer based GIME, miniaturized sensor. The NEXOS Ocean Sensors project will also explore new platforms. There are so many different sensors that GEOSS needs to broker access to complex data sets. Collection of Ocean data should include systematically resources for data sharing and access. The EC will provide support for the development of EO data sharing and access.
Cindy Chandler spoke about NSF funded marine research in the US. It is no longer enough to collect data by yourself, publish the paper, and move on to the next research question. We see greater expectations from funding agencies, researchers, and the larger community for open data access and machine access. (D. McGuinness, Fall AGU 2012, Community Science - The Next Frontier). BCO-DMO provides data management support at no cost to researchers funded by program managers who fund BCO-DMOBCO-DMO is one data office in the US, funded to work in partnership with marine research scientists to provide data stewardship for marine science data generated from hypothesis-driven research. Data from current hypothesis-driven-research projects are managed (marine biogeochemistry and arctic data). There is a great variety of data. It is unlikely that measurements will be the type used before. Lots of types of data, both in-situ and remotely sensed data, are managed. Social science data are included. There are new data types like metabolomics. Cruise based data goes into R2R but BCO-DMO manages post cruise data. A common semantic framework is needed to get across these data types. Community organizations with funding are needed: NSF EarthCube, ESIP, RDA, and ODIP NSF (EarthCube: http://earthcube.org/; ESIP: http://esipfed.org/; RDA: https://rd-alliance.org/; ODIP:
http://www.odip.org/. Partnerships are how interoperability will be achieved.
Dawn Wright presented the view from Ersi, where private industry is the third leg of the stool concerned with interoperability. The system consists of: standards, open data, and interoperability. The stages of data are collecting, storing, serving, discovering, and using the data. Support for NetCDF, OGC, and Metadata and SDI are standards that facilitate interoperability. Esriurl.com/multid has video of data management. Interoperability through standards and specifications: WMS, WFS, WCS, WMTS, WPS. Support for KML for serving data is covered. There is a progression in serving data from GDAL, OpenLayers, to Koop, and Leaflet. Storing the data uses HDFS, GDAL, CGAL, COTS. Discovering the data is geospatial serving 200 Tb, 2.5M items, 1.6M users, 160M accesses a day. Esri GEO Portal geoss.esri.com. Use of data through hypothesis-driven-research, open-source SDKs and APIs for various developers on various hardware platforms and operating systems, open-source template apps, content management systems, etc. Esriurl.com/ocnres and esriurl.com/scicomm are the URLs.

Discussion. Tom O'Reilly asked about costs. How do you convince the community to change the way to share data? Dawn said that the formats are evolving continually so Esri works with

the existing formats and standards. It doesn't require that everyone overturn their labs when the technology progresses. Cindy said there is never enough money or time to transform to the new structure. It has been possible to layer on the older structure. Standards are the only way to make progress. Identifying common approaches and standards early on in the process is cheaper. Taking advantage of research in other groups has worked. Tom pointed out that it is necessary to evaluate the benefits vs. costs for new standards. Stefano pointed out that using English is an example of using a single standard to move forward. Standards are changing because they are getting better and better. Every organization should select the most useful standard. Every recognized standard should be useful. You should be able to bring your data into the Cloud and everyone should be able to use it. Simon said the definition of infrastructure is that we notice it when it isn't there. Iain said looking across the Atlantic requires a task group be set up for seabed mapping with Canada and that work is going on now.

Lunch break.

Observatories Panel - chaired by Heidi Sosik; panel members: Laura Beranzoli, Oscar Schofield, and Kate Moran.

Laura Beranzoli presented material from the European Multidisciplinary Seafloor and water-column Observatory (EMSO) Consortium. EMSO is a distributed Research Infrastructure (RI) for monitoring of long-term marine environmental processes. It addresses challenges such as global ocean warming and acidification; Impact and sustainability of marine resource exploitation; and real-time observations of earthquakes and tsunamis**.** Eight out of twelve nodes are operational. 10 countries are involved with three more to follow. Implementation costs were 300M€. ESONET-VI feeds into the EMSO-ERIC with Governance from Regional Teams linked to the central organization. ERIC Official Application submission has been completed. Statutes underwent informal EC check. ERIC Application will be submitted in early 2015. EMSO provides power, communications, sensors, and data infrastructure for continuous, high resolution, (near) real-time, interactive ocean observations. Key Scientific Objectives are Geosciences, Biogeochemistry, Physical Oceanography, and Marine Ecology. Temperature, conductivity, pressure, dissolved O2, turbidity, ocean currents, and passive acoustics. The data portal has three main nodes: PANGAEA, IFREMER, and INGV where data are archived. Key Socio-Economic Impacts from Horizon 2020 are addressed, with a wide range of services in areas such as: scientific, industry, test bed, E-infrastructure, training, and education. EMSO is linked in Europe with other major initiatives such as a partnership agreement with SIOS, and cross-collaboration with other RIs: EURO-ARGOS, EPOS, ICOS, EMBRC, LIFEWATCH and KM3NeT. There are links to other Major Global Initiatives: ONC, OOI, DONET, IMOS.

Globally there is connection with Canada, US, Japan, China, Taiwan, Australia. The EMSO business model has 7 components. In year 3 the revenues will exceed expenses. Oscar Schofield discussed OOI, which is in the final stages of installation as a service oriented system. 2014 has been an amazing year. There are over 800 unique sensors. Most of the Coastal arrays are in with some of the Global arrays completing their installation in early 2015. OOI is a facility open for researchers to use or write proposals to do research with. SNAP is a trans-basin observing system. A lot of the design is about sampling across the coastal and open ocean interface. ONC and OOI have comparable facilities in the Pacific. Low oxygen water ventilating the coastal waters is a target of the observations. Ocean-atmosphere interactions are a target as well. One mandate is the Shallow Profiler. This will be a 20-25 year duration system. A 200m platform has been designed and deployed. A deep profiler is included. And a seafloor platform on the network is part of it. On the East coast the Pioneer array is directed at high frequency high resolution sensing. Web based services allow tracking any sensor through its life from calibration to observations. It is to increase crowd sourcing and can be used in the classroom. Web tools allow all to access the ocean (and a paper has been written).

Kate Moran acknowledged the work from data that John Delaney helped create. ONC is a non-profit society to operate the observatories. The cabled observatory went in in 2009 with fixed assets but now also has assets on the ferry and has coastal radars. These informed the OOI. Also there is a station in Cambridge Bay (Arctic). There are 14 places that are sharing data now across North America. Economic development is supported by these observations. Big Data: OCEANS 2.0 is recognized by the International Council for Science World Data Systems. Smart OCEANS BC can alert based on earthquakes. Seismometers, bottom pressure recorders allow far field earthquake and tsunami warning, Wally is a crawler used in Neptune. Seeing into the deep ocean like jellyfish (illustrated) can be seen in real-time. Seafloor in the ocean is a clue to seismic activity. A seismic profiler is useful for identifying choke points for salmon. Digital hydrophones along the coast permit coastal soundscape discovery. Animals dwell above hydrate seeps. Smokers have been studied. Tsunami monitoring is important because BC has a subduction zone like that off Japan. Crowdsourcing images from the observatory have been used for salmon fisheries. Heidi asked how these resources can be used to help the community. Kate said it could help students and researchers get grants. It costs $16M/yr. Oscar said that OOI is still putting things in the water but a community is needed to lower the barrier to sharing. Kate said that in Canada there is a separate Innovation Center to develop new sensors, like pH sensors. Mark asked how data from different sensors can be combined. Kate said workshops about using data have helped. Dawn asked if the X-Prize has helped. Kate said they are involved. Gilles asked about the structure of Neptune; is it a public private partnership? Do the communities really want to help? Kate said it is a public private partnership as required (IBM provided $11M) and the port of Vancouver was interested in reducing their impact on marine mammals. Jay asked how to actively collaborate when you have a new sensor that you want to put on all the observatories. Kate said the sensor information comes to their research group who evaluates it and if it has funding it goes to the engineers. There is compatibility with the US observatories. The ONC Data manager is talking all the time with the OOI manager to see if they are aligned. Oscar said that there isn't a uniform standard although it started that way with engineers at first and that wasn't liked. Laura said it is an issue within Europe at the moment. It needs to be much more interoperable within Europe. Kate said OCEANS 2.0 would be a standard if we wanted one. Heidi summarized what we need to do to make ocean observatories more used. Some kind

of grants to students or young investigators to share solutions instead of inventing new ones is needed. More solutions for intercomparing data streams sponsoring workshops on key topics to promote proper use of data would also be good. Is there a role for social science teams? Citizen Science? That community needs to grow. Sensor interfaces do not exist but maybe it isn't so bad. There isn't a standard. Gilles said that the public private partnership helps prevent the government from defining the standard. Dawn said that the Ocean Study Board had a meeting about the Public Private partnership. Simon said it was BP's need to have a baseline.

Oscar Schofield chaired a discussion on gliders.
Jay asked how the US can have a glider program, also a question in Europe. Oscar replied, the US glider backbone has been percolating for a while. Now the number of operators has exploded. The number of publications based on gliders has risen exponentially now 20 years after Stommel proposed them. Deepwater Horizon, hurricane monitoring, water quality, and the glider palooza was that you bring your own glider and your own funding. But you share the data for a regional array. The idea was in June 2013 but it was more than lots of gliders. It described the MAB cold pool. It demonstrated the surge capacity during storms. It gave a unique data set for ONR. It allows tracking whales, tiger sharks, salmon despite what it had been programmed to do. It demonstrated a National Backbone Glider Network. Data flowed from IOOS to GTS. Undergraduate education worked naturally. Outreach engaged the public. Glider-palooza 2014 Partners grew to 18 partners with 27 gliders from the Gulf of Mexico to St. John's and Bermuda. NSF OOI Pioneer Array Gliders were involved. MARACOOS Statistical and Dynamical Ocean Models and SPT: Slocum Power Tools. Jay asked about the data. Oscar said the DMAC system is what the glider provides, The Navy is more mature since it uses the data for its forecasting network. 20% of the gliders carried ADCPs strapped to the top but all had CTDs and most had O2. If a sensor was available there was no objection to installing it. Two bays were available with real-time acoustic listening. Tom asked if the bandwidth was limiting? Oscar said that spectroscopic work requires processing and acoustics will certainly require extraction of signal. Low power Intel chips might allow running ROMS on board. Marciej asked if the community is becoming united. Oscar said as more operators are getting involved it is grass roots, an undergraduate mission where Iridium has donated all the communications for free to do an Endeavor like mission. A CODAR array saved lives so HF Radar became a National plan under IOOS. The same thing could be done for gliders.

Oscar Schofield gave the OOI report.
The OOI Cyber infrastructure isn't the same as last year. Web based services are still there. There is a Demonstration Sensor. The core system grew out of UFrame. Raytheon manages it. All upgrades propagate across all the users. The decision was made at the NSF level. It is running at Rutgers today with glider data and wire profiler data. Data from the Pioneer array Ocean Station Papa showed two warm rings. The difficulty is that the data has to go out as soon as those responsible for it see it, no home court advantage. We need to know what is wrong as soon as it appears. Drivers are being tested as soon as data are acquired. Data validation, science testing and verification are immediately used. At the Pioneer wire profiling site off Martha's Vineyard data flows through OOInet. Quick look plots check that the data are not garbage. The monitors are not PhD level scientists. Science and engineering data are then used to identify issues warranting deep dives. Ship and shore-based sensor verification is linked in the asset management system. At-sea procedures are used with English (not engineering) language.

QARTOD tests are used. A marine operator is in charge of the hardware. Open access high frequency diverse data for sustained periods of time are produced. The ability to enable science as is, provide an infrastructure expanded by investigators, and can provide leverage to other programs. Coupled tools enable teaching and shared community education resources.
Break

Reports

Martin Visbeck reported on the AtlantOS project. Blue Planet Oceans and Society enables sustained ocean observations via GOOS, Argo, HF Radar, OceanSITES and more. The OceansObs'09 Framework for Ocean Observing is "A Simple System": Input (requirements), Process (observations), and Output (Data and products). Essential Ocean Variable will be obtained. We need to distinguish between concepts, pilot and mature systems. The structure of the framework includes Requirements, What to Measure, leading to Essential Ocean Variables. Martin briefly discussed Copernicus, and the Global Ocean Observing System, an Integrated System designed to meet many requirements. In the Galway Statement the European Union, US, and Canada agreed to join forces on Atlantic Ocean Research. In response to Horizon 2020 call BG-8-2014: *Developing in-situ Atlantic Ocean Observations for a better management and sustainable exploitation of the maritime resources,* the AtlantOS project proposal was submitted and is being negotiated. The coordinator is Geomar. The work packages are WP1 to WP11.

Discussion: When will it start? April 2015. Will there be international participation? Yes – US, Canada, Brazil, and South Africa are formally included and will sign the contract. The project is also looking for advisors outside the US.

Jay Pearlman, spoke for another working group, the Bio Task Team led by Francisco Chavez for Bio Sensors. This task is to start in early January and finish by March 2015

Hans-Peter Plag reported on meetings on Blue Planet and SB01; the next meeting will be in Cairn May 26-28 2015 with a session on each task component. This conference is available on the web. A joint meeting in 2016 will include RCN and the Coastal Zone Community of Practice and will be in the US. On a separate topic, A GEO stakeholder meeting was held in Bonn in 2012. The next geo-science stakeholder meeting will focus on navigating sustainability on a changing planet; it will be held in March in Norfolk, Va. Societal goals will be discussed. A second workshop, looking at GEOSS in 5 to 10 years, sponsored by ConnectingGEO, will be in Norfolk in March, 2015 as well.

Deb Glickson, from the National Academy of Science and Engineering, spoke about the Decadal Survey of Ocean Sciences 2015. NSF is looking at their budget, balancing infrastructure versus Ocean Science. The academy has been asked to develop a set of science priorities what could move oceanography forward in the next ten years (not more than ten things). Partnership with other agencies is encouraged. The report is not yet done; it will be released in January or February.

Heidi Sosik and Jay Pearlman reported on the working group on Insitu and Remote Satellite Sensing. Topics that were discussed were: What technology is coming in the next decade that impacts coastal processes? A region of the coast was selected where there is a significant influx of fresh water. Recommendations were made for satellite observations. They cover four areas: Satellite Observations; in situ observations; Data, analyses and modeling; and Education. Regarding Satellite observations, Geosynchronous and polar satellites provide complimentary coastal observations. Satellite missions: PACE, GEO-CAPE, and HyspIRI could cover coastal areas in defining these missions. The review of these requirements is needed during the development for the Decadal Survey. There is a strong need for satellite data to be interpreted by a broad group of users. In situ observations should use a coastal Argos float with sensors that track bio variables. They need to have PUCK type sensor interfaces for interoperability. High resolution is needed (<1km). Quality assurance is very important. Bringing bio-optical models into the coast doesn't work very well. Like the weather system for atmospheric measurements, validated model outputs will be the primary format that is used. Improved interoperability between sensors and relevant models is needed. We anticipate the need for expanded education at the undergraduate and MS level.

Citizen Science panel – chaired by John Orcutt.

John Orcutt provided a brief introduction. OpenScientist.org is a web site and presents the work by vocational scientists. Newton, Franklin, and Darwin were prototypes. Funding is very small for Citizen Science. Examples are Galaxy Zoo, SETI@home, Cornell Lab of Ornithology, and CARIB Tails. An earthquake was tracked by the JAWBONE UP Fitness Tracker.

Julia Parrish at UW studies sea birds. She talked about science is a team sport . We have scientists and citizens. We don't have citizen scientists since it takes too long to train them. There is informal science where information might be collected like crowd sourcing; if data are analyzed it is rigorous science. Julia introduced several citizens science projects. The Community Collaborative Rain, Hail and Snow Network (CoCoRaHS) measures and maps

precipitations; the project has about 20,000 participants and adds 300-400 people per year. Galaxy Zoo is a couch potato job where volunteers sort HUBBLE images. A coastal version, Plankton Portal, measures images of marine organisms. Also it is classifying them. EBird identifies location of bird species by bird watchers. Foldit is a crowd source that asks the player to deduce a structure for very complex molecules. Julia's program , the Coastal Observation and Seabird Survey Team (COASST) is 16 years old, 2500 people are trained, 850 birds found. Examination of each carcass starts with the foot. If it doesn't match it is rejected. COASST has training. When many birds have been found, the false positive and false negatives are very small. Some participants have been doing it for a long time. Sea Star Wasting Disease is another project. Getting participants to do more than push a button gets them jazzed (and these people vote). This is a win win.

Mairi Best spoke about Citizen Science in Europe. There is a European Citizen Science Association (ECSA). There are 40 members in 16 countries with 4 working groups. Cross-cutting tools for environmental infrastructure in ENVRI are grouped in 4 areas: solid earth, atmosphere, marine, and biosphere. JERICO is in the Marine quadrant. ERIC process lets it become a legal entity. Tools related to citizen science include: 1.resources and best practices for public contributions to the annotation of imagery (a charismatic form of scientific information with which to engage the public, while also being a resource-intensive information source for RI's (a charismatic form of scientific information with which to engage the public, while also being a resource-intensive information source for RIs); 2.a framework for distributed networks of observers and sensors who collect data and can perform response actions. Here are some examples of citizen science initiatives: Seismometers have been distributed to individuals, connected to their desktop computers for better resolution of earthquakes; Campaigns for coastal observations, species counts, images taken and uploaded to shared data archive, qa/qc and analysis; Annotation of images, gaming as training; and Optical characteristics of water, instruments built and maintained by citizens.

A one-day conference took place December 4, 2014 in Brussels to look at the role and opportunities for active citizen participation in environmental monitoring and policy making. Five projects were included: Citclops; CITI-SENSE; COBWEB; Omniscientis; and WeSenseIt. Citclops addresses the Properties of light in surface waters. It uses KdUINO, a citizen built technology, based on an Arduino board, which measures light attenuation. Citizen science consortia perform observations, instrument construction, instrument deployment, operation, and maintenance, and data analysis. Operational tests were conducted during the freeze up condition in northern Ontario. Participation by citizen scientists provides the following benefits: 1) it raises societal awareness, engagement and trust in environmental science; and 2) it provides data that is otherwise logistically inaccessible for monitoring change on our planet. It is important to engage, train, and encouraging active citizen scientists, and to provide data systems for the acquisition, assessment, access, and analysis of distributed data sources.

Gilles Ollier said that his term in the European Commission for the above activities is "Citizen Observatory". It is much more focused than Citizen Science. In a decade, Smart phones will have ten times as many sensors as they have today; they will be able to perform passive observations to monitor the environment. For example, you can monitor the noise level in the city now. There will be a call for proposals in 2015 for this kind of thing. The first step is to work with target groups.

Summary by Jay and Sandy.

There is a need for an X-Prize for data management. Planning for the Blue Planet is underway. Two working groups have been reported and the reports will come out in February. We will plan for the next Face-to-Face meeting of RCN on the Sunday before fall 2015 AGU in San Francisco.
The meeting was adjourned at 17:30.